DROP CAP FOR DOSING THE AMOUNT OF LIQUID IN A DROP AND CONTAINER COMPRISING A DROP LID

Description

The invention relates to a dropper cap for dispensing a liquid in the form of drops from a container, the content of which can be put under pressure for dispensing, with a cap body in which a discharge channel and a restrictor device are arranged. The invention further relates to a container with a dropper cap.

Medications used in liquid form are provided in tubes or bottles from which they are dispensed in the form of drops. Since the medication is linked to the number of drops, it is important that the drop volume remains constant and cannot be influenced by the user during dispensing.

When liquid medications are provided in glass bottles, the dropper insert, in addition to the discharge channel, has an air duct through which air can flow into the interior of the bottle during dispensing.

In the case of bottles or tubes made of a flexible plastic material, the dropper cap has only a discharge channel through which the liquid is dosed by pressing on the container wall. Here, it is important that the discharge channel exactly defines the size of the drops.

Such a dropper tip for eye drops is described, for example, in EP 0 431 885 A1. The discharge channel has an intake opening whose cross section is smaller than

that of the discharge opening. The size of the discharge opening essentially determines the size of the drop. To determine the optimal dimensions, extensive experiments were conducted to prevent the liquid from being discharged in a stream rather than in the form of drops when the user applies too much pressure to the container wall. It has been found that not only the conical shape of the discharge channel but also the outer shape of the dropper tip has an influence, particularly if the container is held at an angle.

EP 0 956 904 A1 describes a dropper insert that can be inserted into a container. This dropper insert is intended to deliver the liquid in constant drop sizes, independent of the pressure exerted on the liquid. Starting from a discharge channel with an intake opening that is smaller than the discharge opening, this document proposes not only conical discharge channels but also discharge channels with cylindrical sections.

Although EP 0 956 904 A1 states that the form of the drops is independent of the pressure exerted on the liquid, it has been shown that this is not always true. Particularly if relatively great pressures are exerted to produce larger drops, it has been shown that a stream is delivered starting from a certain pressure value, or the drops assume an uncontrolled shape and consequently cease to have a defined volume. Thus, dosing reliability is no longer ensured.

Other drawbacks of these dropper caps of the prior art are that the drop sizes that are produced are not constant for all liquids. Depending on the viscosity and the wettability of the liquids to be dispensed, uncontrolled drop shapes may occur even if the diameters of the discharge opening, which are typically less than 2 mm, are small.

These negative effects occur more frequently with larger discharge openings, e.g. with diameters of 5 to 10 mm.

Large drops are required, however, whenever larger amounts of liquid must be dosed and the laborious counting of a large number of small drops is to be avoided.

United States Patent US, 5,356,052 discloses a plastic container with a drop dispenser, which has a restrictor device in the discharge channel. This restrictor device consists of two adjoining wall sections, which push against one another in the stand-by state. As soon as pressure builds in the interior of the container as the container walls are pressed together, the wall sections forming the restrictor device are pushed apart and unblock an aperture for dispensing the liquid. The drawback of this restrictor device is that additional pressure must be initially applied to open the restrictor device, and the liquid can be dispensed only after the pressure is further increased. Thus, a relatively large pressure acts on the liquid, which has the result that the liquid is dispensed abruptly at great speed. However, since drops are to be dispensed instead of a liquid stream, the size of the drops strongly depends on the pressure applied by the user. As a rule, the reproducibility of the size of the drops is not ensured. The pressure at which the restrictor device opens essentially depends on the elastic properties of the container material, so that different pressures must be applied for different types of material, which requires the user to adjust. It is therefore desirable to find a way to dispense the liquid at a constant drop size, irrespective of the selected container material.

One object of the invention is thus to provide a dropper cap that reliably dispenses the predefined drop volume even if the drops are large. This volume

should be maintained independent of the pressure exerted on the liquid. A further object of the invention is to provide a container with a corresponding dropper cap.

This object is attained by a dropper cap for dispensing liquids in the form of drops in which the restrictor device is arranged upstream of the intake opening of the discharge channel in flow direction.

The pressure applied to the liquid by the user may not propagate into the discharge channel but must be reduced upstream of the discharge channel to the point where the pressure ratios cause drops to form in the area of the discharge channel. The restrictor device disposed upstream of the intake opening makes it possible to adjust the maximum pressure acting on the liquid to be dispensed upstream of or within the discharge channel. The restrictor device ensures that the pressure ratios within the discharge channel are always constant, even if the pressure exerted on the liquid is high.

The restrictor device is preferably arranged at a distance from the intake opening of the discharge channel. Since the liquid passes through the restrictor device at a great flow rate when the pressures exerted on the liquid are high, the liquid could enter the intake opening directly as a stream. In this case the stream would propagate within the discharge channel, which might prevent the formation of a constant drop size. The arrangement of the restrictor device at a distance ensures that the liquid flowing through the restrictor device can spread before it reaches the intake opening.

This effect can be further enhanced if an intermediate chamber is arranged between the intake opening and the restrictor device. This intermediate chamber

has the advantage that the liquid can first collect here before it enters the intake opening of the discharge channel.

The volume of the intermediate chamber is preferably greater than or equal to the volume of the discharge channel. This ensures that the entire volume necessary for a drop is made available in the intermediate chamber at a suitable pressure.

The intermediate chamber is preferably defined by the cap body and a chamber wall.

The restrictor device is preferably arranged in the chamber wall.

The restrictor device can have at least one passage opening in the chamber wall whose diameter is smaller than the diameter of the intake opening of the discharge channel. Other restrictor devices, such as flap valves or the like, can also be used.

The passage opening can be located opposite the intake opening. It is advantageous, however, if the passage opening is offset relative to the intake opening. This causes the liquid stream formed by the passage opening to be deflected first, so that its pressure is further reduced.

The chamber wall preferably consists of an annular wall and a partition wall. The annular wall can be adapted to the dimensions of the cap body. The restrictor device is preferably arranged in the partition wall.

The chamber wall is preferably molded onto the cap body.

The dropper cap and the container can be combined in different ways.

The dropper cap according to the invention can be an integral component of the container.

For production reasons, however, the container and the dropper cap are produced separately and the dropper cap is subsequently inserted into the neck or the spout of the container.

This can be realized in two variants. According to a first variant, the dropper cap according to the invention is provided as an insert that can be inserted into the container neck of any conventional container.

According to a second variant, the spout of the container can have a conventional dropper cap in the discharge channel.

In this embodiment, the restrictor device is disposed in a partition wall of the container, and this partition wall is arranged in the interior of the container at a distance from the dropper cap

The partition wall is preferably arranged within the container neck.

Preferably, the partition wall is disposed perpendicularly to the container axis. The partition wall can be insertable into the container or form an integral part of the container.

The restrictor device is preferably disposed in this partition wall.

The restrictor device comprises at least one passage opening whose cross section is smaller than the cross section of the intake opening of the discharge channel. The maximum pressure acting on the discharge channel can be adjusted through the selection of the cross section of this opening. This ensures that the liquid to be dispensed enters the discharge channel at the same pressure, so that the pressure applied by the user does not affect the shape of the drops.

The passage opening is preferably located opposite the intake opening. In this case it is important that the distance between the restrictor opening and the intake opening is as large as possible, so that the entering liquid cannot reach the discharge channel directly, which could again cause a stream to form at the end of the discharge opening of the discharge channel.

To obtain a further improvement in this area, the passage opening is preferably offset in relation to the intake opening.

Preferably, the volume of the gap between the dropper cap and the partition wall is greater than or equal to the volume of the discharge channel.

The conventional container, or the container according to the invention, preferably has a flexible container wall made of plastic, for example. The container can be a tube, a bottle or some other suitable container. The flexible container wall makes it possible to put the content of the container under pressure, e.g. manually, so that the liquid can be dispensed.

It is also possible, however, to provide a pressure device on or in the container, or to enable the container to be connected to a pressure device. A pressure device

would be, for example a pump mechanism used to pump air into the interior of the container, causing the liquid to be pushed through the restrictor device.

The dropper cap can be inserted into the container neck in a liquid tight or pressure tight manner. A tight joint with the container can be produced, for example, by welding the dropper cap.

Embodiments of the invention, will now be described in greater detail, by way of example, with reference to the drawings in which:

FIG 1 shows a vertical section of a container with an inserted dropper cap according to a first embodiment,

FIG 2 shows a vertical section of a container with an inserted dropper cap according to a second embodiment, and

FIG 3 shows a vertical section of a container according to the invention with a conventional dropper cap.

FIG 1 shows a vertical section of the area of the container neck 3 of a container 1. The container wall 2 that defines the interior 6 of the container 1 is shown only in part to make it possible to draw the dropper cap 10 disposed in the container neck 3 or the spout to a larger scale.

On the outside of the container neck 3, an external thread 4 is formed, so that a screw cap (not depicted) can be placed onto the container neck 3. The container

neck 3 is cylindrical and receives the dropper cap 10, which has a substantially cup-shaped cap body 11 with a bottom wall 13 and a peripheral wall 14.

The cap body 11 has a dispenser fitting 12 in its center, in which a discharge channel 20 is arranged. The dispenser fitting 12 extends from the horizontally arranged bottom wall 13 vertically upwardly and protrudes over the peripheral wall 14, which has an annular flange 15 at its upper end, with which the dropper cap 10 rests against the end face of the container neck 3 where it can be fastened.

The outside diameter of the peripheral wall 14 corresponds to the inside diameter of the container neck 3, so that the dropper cap 10 can be inserted into the container neck 3 in a liquid tight manner.

The discharge channel 20 has an intake opening 21 with a small diameter at its lower end, i.e. in the area of the bottom wall 13, such that this diameter is smaller than the diameter of the discharge opening 25 at the upper end of the dispenser fitting 12. The intake opening 21 is adjoined by a cylindrical intake section 22, which merges into a conical section 23 that expands in the direction of the discharge opening 25. The conical section 23 is adjoined by another cylindrical section 24, which forms the discharge opening 25. The diameter of the discharge opening 25 can range, for example, from 5 to 10 mm. The cross section of the discharge opening 25 defines the drop size.

The discharge channel 23 can also have other cross-sectional shapes, as depicted and described, e.g., in EP 0 956 904 A1. It is not necessary for the intake opening to have a smaller cross section than the discharge opening. Depending on the type of liquid, it is possible to produce drops with a cylindrical discharge channel.

A downwardly extending chamber wall 32 defining an intermediate chamber 35 is molded onto the bottom wall 13. In the embodiment shown here, the chamber wall 32 consists of an annular wall 33, whose diameter corresponds to the inside diameter of the container neck 3, and a partition wall 34 extending perpendicularly to the container axis.

A restrictor device 30 in the form of a passage opening 31, whose cross-section is smaller than the cross section of the intake opening 21, is arranged in the center of the partition wall 34.

The chamber wall 32 is an integral component of the dropper cap 10, which together with the intermediate chamber 35 extends over the entire length of the container neck 3. In containers with a shorter container neck 3, the intermediate chamber 35 can also protrude into the interior 6 of the container. In the embodiment shown here, the volume of the intermediate chamber 35 is larger than the volume of the discharge channel 20.

FIG 2 depicts a further embodiment in which the container neck 3 is shorter than the neck of the container 1 shown in FIG 1. The intermediate chamber 35 is likewise cylindrical, but the volume of the intermediate chamber 35 is smaller than in the embodiment according to FIG 1. In this embodiment, too, the volume of the intermediate chamber 35 is larger than that of the discharge channel 20.

In contrast to the embodiment according to FIG 1, the passage opening 31 is eccentric and thus offset relative to the intake opening 21 of the discharge channel 20. This is advantageous in this embodiment insofar as the distance of the partition wall 34 from the intake opening 21 is clearly shorter than in the

embodiment of FIG 1, so that an immediate transfer of the inflowing liquid from the passage opening 31 to the intake opening 21 is prevented.

In both embodiments, the container wall 2 is made of a flexible material, so that by squeezing the container wall 2, the liquid to be dispensed can be pushed through the passage opening 31 into the intermediate chamber 35 and thus into the discharge channel 20.

FIG 3 shows a further embodiment in which the innovation relates to the container 1'. The dropper cap does not have a chamber wall as shown in FIG 1 and 2 but consists of a substantially conventional dropper cap 10', which is inserted into the container neck 3.

To be able to arrange the restrictor device 30 at a distance from the intake opening 21 of the discharge channel 20, a partition wall 34' is inserted in the lower area of the container neck 3 and is provided with the restrictor device 30 in the form of an eccentric passage opening 31. The intermediate chamber 35' is located between the partition wall 34' and the bottom wall 13 of the dropper cap 10'. Thus, in this embodiment, the restrictor device 30 forms part of the container instead of the dropper cap 10'.

This configuration of the container 1 according to the invention makes it possible to use conventional dropper caps 10'.

In all the embodiments shown in FIG 1 to 3 it is also possible to arrange a plurality of passage openings 31 in the partition wall 34, 34', in which case the sum of the cross sections of the passage openings 31 should be smaller than the cross section of the intake opening 21 of the discharge channel 20.